

**We claim as follows:**

1. A method of producing a polymer-clay nanocomposite, comprising the steps of:  
providing a supply of polymer-clay mixture;  
exfoliating the mixture through solid-state shear pulverization in the  
5 presence of cooling sufficient to maintain the extruded mixture in the solid state  
during the pulverization; and  
discharging the resulting exfoliated mixture.
2. The method of claim 1, further comprising the step of melt-extruding the  
10 polymer-clay mixture prior to said step of exfoliating.
3. The method of claim 1, wherein the polymer-clay mixture comprises at least  
about 3% organoclay.
- 15 4. The method of claim 1, wherein the polymer-clay mixture comprises about 10%  
organoclay.
5. The method of claim 3, wherein the organoclay contains between about 40-50%  
clay and between about 50-60% organic content.  
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6. The method of claim 5, wherein the organoclay is a montmorillonite.
7. The method of claim 1, wherein the polymer-clay mixture comprises a polymer  
selected from the group consisting of polypropylene, polyolefins, polystyrene,  
25 polymethacrylates, poly(ethylene-co-vinyl acetate), polyhydroxystyrene, poly  
(vinyl pyridine), polyvinylalcohol, polyacrylamide, polycaprolactone, copolymers  
of ethylene, copolymers of propylene, copolymers of acetate, poly (ethylene  
terephthalate), nylon, and blends thereof.
- 30 8. The method of claim 1, including the step of cooling a pulverizer barrel with a  
chilled fluid at about 10° Celsius during the pulverization.

9. A polymer-clay nanocomposite, comprising:  
a nonpolar polymer material; and  
at least about 3% highly exfoliated organoclay.
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10. The nanocomposite of claim 9, wherein said nonpolar polymer material is selected from the group consisting of polypropylene, polyethylene, polystyrene, copolymers of propylene, copolymers of ethylene, and blends thereof.
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11. The nanocomposite of claim 9, wherein said nonpolar polymer material is a polyolefin.
12. The nanocomposite of claim 9, wherein said organoclay comprises between about 40-50% clay content and between about 50-60% organic content.
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13. The nanocomposite of claim 12, wherein said organoclay is a montmorillonite.
14. The nanocomposite of claim 13, wherein said organoclay has:  
40-50% nanoclay content,  
a density of 38-48 lbs/ft<sup>3</sup>, and  
a maximum of 0.2% moisture content.
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15. The nanocomposite of claim 9, including about 10% highly exfoliated organoclay.
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16. A method of producing a polymer hybrid nanocomposite, comprising the steps of:  
providing a supply of polymer material;  
mixing the polymer material with a reinforcing material to form a mixture;

effecting a high level of dispersion of the reinforcing material throughout the mixture through solid-state shear pulverization in the presence of cooling sufficient to maintain the mixture in the solid state during the pulverization; and discharging the resulting mixture.

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17. The method of claim 16, wherein the reinforcing material is selected from the group consisting of a metal, carbon, silicate and cellulose.